

Using Infant Simulation to Reduce Pregnancy Among High School Students

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Abstract

A long-term public health goal in the United States involves convincing adolescents to postpone sexual activity or promote responsible sexual activity. This study investigated the effect of using infant simulators on sexuality, child care attitudes and knowledge with a sample of 309 high school students from seven different states. The treatment group included 152 students and the comparison group included 157. Students completed a posttest that assessed their attitudes and knowledge, and completed a follow-up conducted nine months later. The treatment group completed a structured, skill-based curriculum developed by Realityworks and utilized the Realityworks infant simulator. The comparison group completed a curriculum developed by their school districts and did not use the infant simulator. Chi-square analysis was used to analyze posttest and follow-up attitudinal responses, and analysis of variance (ANOVA) was used to compare scores on the cognitive test. Results indicated that the treatment group surpassed the comparison group on attitudes and cognitive achievement on the posttest and these differences were maintained on the follow-up. The results demonstrated the effectiveness of the curriculum and infant simulator.

Introduction

Educational efforts have focused on convincing adolescents to postpone sexual activity, or to act responsibly if they become sexually active, this has been a long-term public health goal in the United States. After an increase in teenage births between 1960 and 1994, the rate stabilized between the mid-1990s through 2002, but recently the rate has increased. Between 1980 and 2006, the percentage of births to unmarried women rose sharply for women in all age groups. Among teenagers, the percentage rose from 62 to 92 percent for ages 15–17 and from 40 to 81 percent for

ages 18–19 (Hamilton, Martin, & Ventura, 2007). States with the largest populations reported the highest number of adolescent pregnancies. California had 113,000 followed by Texas, New York, Florida, and Illinois with adolescent pregnancies ranging from 80,000 to 37,000. (Guttmacher Institute, 2006).

Teenage parents and their children have more problems than the children of more mature parents. The children of teenage mothers have lower average birth weight than the children of older mothers which results in greater incidence of health problems for these children (Card, 1999). Adolescent mothers are at high risk of adverse outcomes. These include failure to graduate from high school, unemployment, and remaining on public assistance. They also have a higher likelihood of socio-emotional problems such as low self-esteem, high life stress, and depression (Whitman, Borkowski, Keogh, & Weed, 2001). Teen motherhood is linked to other social problems including fewer employment and educational aspirations (McLeod, 2001) and higher rates of stress (Hudson, Elek, & Campbell-Grossman, 2000). Pregnant adolescents exhibit major depression and conduct disorders (Azar, Paquette, Zoccolillo, Baltzer, & Tremblay, 2008), and adolescent mothers and their partners have increased risk for engaging in dysfunctional parenting, including child abuse (Moore & Florsheim, 2008).

Sexuality programs for adolescents offered by school districts vary. Some focus on use of contraceptives or abstinence and range from short, stand-alone units of study to comprehensive programs integrated into health education classes. Most of these programs increase student knowledge about reproduction, but knowledge alone does not change adolescent sexual behavior (Denehy, 2007; Eisenberg, Bernat, Bearinger, & Resnick, 2008; Kirby, 2000; Kohler, Manhart, & Lafferty, 2008).

Infant simulators have been used in many sexuality programs offered to adolescents. Simulation techniques, which are based on theories originating in psychology, sociology, or economics, range from simple role-playing to elaborate computer models. Some simulations partially replace real world events, while others create miniature societies. The most effective simulations model the precision and richness of reality and expose participants to life-like events (Bredeweg & Voss, 1992). Unfortunately, the use of reality-based simulators has been limited in American public schools. Few, if any, simulations available for public education approach the imagination of those created by the computer-game industry.

Gredler (1996) described the essential components of experiential simulations that emulate reality. These components include a complex task that adapts to participant behavior;

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serious role in which participants assume responsibility for scenario-required activities; multiple plausible paths through the experience; and participant control over decision-making. The RealCare II infant simulator, widely known by its original name as Baby-Think-It-Over (BTIO), is a good example of an experiential simulation because it is a non-linear, psychological experience in which participants play a defined role with specific responsibilities within the evolving reality of parenthood. It is a fluid, dynamic case study with participants on the inside.

The simulator is a life-like model with different ethnic characteristics that is 21 inches long and weighs 6.5 to 7 pounds. It randomly displays infant behaviors by following the schedules of real infants. Students feed the infant with a bottle or breast-feeding device, change diapers, and hold the infant while rocking or burping. The infant's head falls back if it is not properly supported. If the infant is handled roughly, it cries and must be comforted until the crying stops. A computerized monitoring unit produces reports that document how well students cared for the infant. The report shows how many times the infant was neglected, handled roughly and shaken, as well as how many times feeding, burping, rocking, or changing were required. Usually the infant is used as a device in health education courses that include child development, sexuality education, and child care as major sections of the curriculum. Typically students care for the infant during a weekend that begins on Friday afternoon and ends on Monday morning (Reality Works, Inc., 2001).

Prior research on the infant simulator is limited. Three studies had students complete a 3-day experience during which they cared for an infant simulator. Strachan and Gorey (1997) compared at-risk students from impoverished neighborhoods. Somers and Fahlman (2001) compared middle-class white students to no-treatment comparison groups. Barnett (2006) compared two intact groups of 49 tenth-grade students who were enrolled in state-mandated health education classes. The treatment group used the BTIO simulator, and the comparison group did not. None of these studies showed significant differences on posttest scores of attitudes toward parenting and sexual behavior.

Tingle (2002) randomly selected 25 North Carolina teachers who sent surveys to the parents of students concerning the effects of the BTIO infant simulator on their children's perceptions and attitudes toward teen parenting. Results from independent t-tests on the constructs by group (comparison vs. experimental) revealed no statistically significant differences for students. Most teachers and parents felt the program increased communication about parenting and changed teen attitudes in a desired direction, but student changes in attitudes and beliefs about parenting after the intervention were minimal.

A study of female Hispanic students in a Colorado middle school reported no significant differences between anticipated and actual difficulties in caring for the infant simulator (Kralewski & Stevens-Simon 2000). The simulator had minimal effects on the desire of the girls to

have a baby during adolescence. Somers, Gleason, Johnson, and Fahlman (2001) found no change in understanding the responsibilities of child rearing among students in two Midwest high schools. Divine and Cobb (2001) used a different infant simulator called "Ready-or-Not Tots" with eighth grade students from urban Midwestern Catholic schools. The students carried these simulators for eight days, compared to studies involving the BTIO simulator that required students to care for the simulator for two or three days, usually over a weekend. Students kept a journal to reflect on their experiences. Follow-up results conducted one and two years after the program showed that the simulator group knew more about infant care and thought that infant care was more expensive, difficult, and time consuming than the comparison group. Out and Lafrenieres (2001) reported that 11th grade Canadian students reported significantly more examples of child-rearing consequences and responsibilities than control group students, but no changes in attitudes toward abstinence and contraceptive use were observed.

Three studies showed strong, positive results for students who used the simulator. Didion and Gatzke (2004) conducted a follow-up survey and focus groups to assess the impact of a pregnancy prevention intervention program. They used the infant simulator two or three years after 11th grade Midwestern students completed the program. The authors concluded that experience with the simulator was effective for teaching complex decision-making strategies to deal with the risks of sexual activity and parenting.

Roberts and McCowan (2004) investigated the effect of using the Realityworks infant simulators on the child care behaviors, parenting attitudes, and attitudes towards sexual behavior with a group of 236 suburban high school students assigned to experimental and control groups. Both groups were trained to care for the infant, but the control group did not receive additional instruction, while the experimental group completed a curriculum that focused on reflection-based parenting skills with specific child care competencies. Findings showed that the experimental group outperformed the control group on child care with the simulator, and that they had significantly better attitudes than the control group toward sexuality and childrearing practices. A group of 353 predominantly ninth-grade and Latino students completed a program involving the BTIO infant simulator. A survey instrument revealed statistically significant gains that showed students were more aware of the impact that a baby would have on their academics, career plans, and social life, as well as the impact on other family members, the emotional risks, and difficulties of infant care (de Anda, 2005). She concluded that the positive results were influenced by the quality of the total educational program that included preparation for the experience, group and individual discussion of the experience, and additional intervention for students who experienced difficulty during the simulation.

Results from these studies showed that the infant simulator can have a positive effect on the attitudes and knowledge of adolescents about pregnancy and child rearing. It seems reasonable to conclude that improved attitudes

and increased knowledge would equip teenagers with more effective skills to cope with issues related to pregnancy and child care. These effects seem to be more substantial when the simulator is combined with a well-designed, structured curriculum. This study was designed to test the effectiveness of an infant simulator called the RealCare Baby II (RCB II) in improving knowledge and attitudes about pregnancy and child care.

Methods

Sample

The 309 students who participated in the study were enrolled in health education classes from 9th to 12th grades in seven high schools located in four different states. They included 152 in the treatment group and 157 in the comparison group. Attrition was minimal since 290 students completed the posttest and follow-up phases of the study. Schools were randomly assigned to treatment and comparison groups. During the random assignment of schools to treatment and comparison groups, the two large schools were placed in the comparison group. The remaining smaller schools were assigned to the treatment group to maintain a comparable number of students in both groups. A chi-square analysis indicated that the treatment and comparison groups did not differ significantly on the following demographics, so it can be assumed that the groups were comparable. Most of the students were enrolled in the 9th (24.0 percent) and 10th (60.5 percent) grades. Females were 58.7 percent and males were 41.3 percent of the sample. Caucasian students represented 54 percent of the sample which also included 19 percent Hispanics, 9.5 percent African American, and 6.2 percent Asian. Approximately 10 percent of the parents did not graduate from high school, and 30 percent of the parents graduated from a two or four year college.

Treatment

This study, which was approved by the institutional review board at the State University College at Buffalo, hypothesized that infant simulator, when used with a structured, competency-based curriculum, will positively affect the attitudes and cognitive achievement of adolescents toward pregnancy and parenting. The following research question was examined: Does the use of infant simulators affect the attitudes and cognitive knowledge of high school students toward sexual behavior and parenting?

The experimental treatment in the study involved students in a program that included the RCB II infant simulator and the Realityworks RealCare Parenting Program. Treatment group students completed training that included the infant simulator and the Realityworks curriculum, while the comparison group completed the curriculum offered by their schools.

The study used a pretest/posttest/follow-up design for two criterion measures including the attitudes and cognitive

performance of the treatment and comparison groups. The total sample of 309 students completed the pretest and posttest, and 290 students (93.9%) completed the pretest, posttest, and follow-up. Realityworks recruited the schools that were involved in the study and provided them with the materials required for the study including infant simulators and the curriculum, and supported the costs involved in conducting the study. Seven high schools were randomly assigned to the treatment and comparison groups. The original sample included five schools in the treatment group and four in the comparison group. Two schools in the comparison group decided that they would not participate in the study leaving a final sample of five schools in the treatment group and two in the comparison group. This investigation was a double blind study since neither the students nor the investigators knew which schools were assigned to either group.

Procedures

Testing was conducted online using *Survey Solutions*, a software package that produces instruments that can be distributed via e-mail or posted on a web-site. Use of this software rather than printed instruments provided an economical alternative for data collection that was more efficient and accurate than other techniques. Students completed tests by using computers available in each high school. Confidentiality was assured by using student ID numbers that were known only by the classroom teachers.

The pretest, posttest and follow-up, which were identical, contained 25 attitudinal items and 25 cognitive items. The attitudinal items asked respondents to indicate how they felt about specific statements using a 5-point Likert-type response format ranging from "strongly agree" to "strongly disagree." Cronbach's alpha for the tests were .82 for the pretest, .87 for the posttest and .81 for the follow-up. The cognitive tests contained 25 multiple-choice items with four distracters that matched instructional objectives contained in the Realityworks curriculum. Attitudinal and cognitive items were validated by a panel of eight experts including two public school health educators, two Realityworks staff, and four college faculty members. The instrument was field-tested with 47 students from two public high school health education classes. Weak items were revised or discarded resulting in the final instrument.

Data Collection

Students completed the on-line pretest on December 4, 2004, the posttest in January 2005, and the follow-up in September 2005. Completed surveys were coded into a database for subsequent analysis and reporting. Pretest, posttest, and follow-up results for the attitude scale and cognitive test were compared to determine whether differences existed between the treatment and comparison groups.

The pretest was used to test whether the treatment and comparison groups were comparable, and the posttest and

follow-up were used to test the effects of the study. Face and content validity were established for the instrument by having the initial draft reviewed by 10 college faculty members and high school health teachers. The reviewers determined whether the content appropriately assessed adolescent attitudes toward specific issues of parenting, pregnancy, birth control, and sexual behaviors.

The attitudinal items were classified into four categories:

- Knowledge: Awareness and understanding of facts, truths or information gained in the form of experience, learning, or introspection.
- Pragmatic: Straightforward practical way of solving problems with concern about practical results.
- Social: The way people behave and interact in groups.
- Responsible: Accountable for successful completion of duties with authority to make independent decisions in a conscientious, trustworthy manner.

Results

Chi-square analysis was used to analyze posttest and follow-up attitudinal responses, and an analysis of variance (ANOVA) was used to compare pretest, posttest, and follow-up scores on the cognitive test. Table 1 compares the results from the chi-square analysis for the posttest and follow-up on the 25 attitudinal items.

Five non-significant posttest items were significant on the follow-up. Each change represented a positive gain in the attitudes of treatment group students. These results show that using the RealCare Baby II in a high school health class improved attitudes immediately following the course, and that these attitudes continued to improve over time. On the follow-up, treatment group students differed significantly from the comparison group on 15 posttest items which shows that the gains in student attitudes on the posttest test were maintained over time well after the course was completed (e.g., "Discussion of parenting/birth control should be done at school."; "Even though they cannot talk, newborn babies show love to parents."; "Newborn babies smile and laugh a lot."). Five items in the treatment and comparison group students did not show differences in attitudes on either the posttest or follow-up which indicates that the treatment did not affect these attitudes.

Table 2 contains the mean scores and standard deviations on the pretest, posttest, and follow-up cognitive test. The pretest mean for the treatment group was 7.33 compared to 7.24 for the comparison group. Posttest and follow-up means for the treatment group were 9.98 and 9.62 compared to 7.04 and 7.21 for the comparison group.

A one-way (ANOVA) was used to compare scores on the 25 item cognitive scores on the pretest, posttest, and follow-up. Items from the cognitive test matched major instructional

objectives that described major skills and concepts included in the curriculum. The tests of main effects are summarized in Table 2. Levene's test for homogeneity of variance was non-significant which verified that the samples had equal variances. The main effects were statistically significant for the posttest ($df = 1$, $F = 53.35$, $p = 0.000$) and the follow-up ($df = 1$, $F = 53.29$, $p = 0.000$) indicating that the mean scores on the cognitive test for the treatment group were significantly higher than the comparison group on the posttest and follow-up.

Discussion

The results indicated that using the RealCare Baby II simulator in conjunction with a well-designed curriculum had a positive impact on student attitudes toward sexuality and pregnancy, as well as knowledge and competence regarding child care. A hands-on, practical experience supported by appropriate instruction improved student attitudes in areas related to effective parenting. The strong agreement on items in the knowledge category clearly demonstrated parenting information was retained.

Student maturation may have interacted with the follow-up results, but the significant effects were sustained and improved over time which is a desirable educational outcome. Consequently, it was concluded that use of the simulator had an immediate and lasting impact. These findings have important implications for health educators whose main purpose is to evoke behavioral change in students.

Students recognized that pregnancy prevention was important because the demands of raising a child would dramatically affect the lives of adolescent parents, showing that students were sensitized about the difficulties of raising children. A good example is the pragmatic item "Having a baby negatively affects a couple's relationship." This item was non-significant on posttest, but significant on the follow-up. Use of the infant simulator requires an investment in equipment, but the investment can be justified since the device provides a serious educational experience that seems to have positive outcomes for the adolescent participants.

The infant simulator provides a concrete, realistic experience for students who are functioning at the concrete operational stage. During this stage, thinking becomes less egocentric with increased awareness of external events, and involves concrete references. Although this stage typically develops from 7 through 11 years, many high school students do not attain the formal operational level until later in life (Piaget, 1972). Kuhn, Langer, Kohlberg, and Haan (1977) estimate that only 30 to 35 percent of high school seniors attain this level. Consequently, the hands-on experience with the simulator provides a concrete experience at a time when students are in the process of moving from a concrete to formal operational stage. This can be a compelling intervention at an appropriate maturational level for pre-adolescents and adolescents.

Adolescents are at high risk of becoming pregnant. They do not think that they will become pregnant and underestimate

Table 1

Chi-Square Comparison of Posttest / Follow-up Attitudes of Treatment and Comparison Groups

Item	Posttest Chi-square		Follow-up Chi-square	
	Chi-square	α	Chi-square	α
Knowledge				
Parents spoil babies by picking them up when they cry.	20.861	.000	13.828	.008
Babies cry just to get attention.	1.983	.578	1.360	.852
Discussion of parenting/birth control should be done at school.	21.942	.000	31.956	.000
Discussion of parenting/birth control should be done at home.	3.464	.307	7.627	.071
Although they cannot talk, newborn babies show love to parents.	48.043	.000	84.326	.000
Newborn babies smile and laugh a lot.	22.161	.000	29.259	.000
Pragmatic				
Children of teenagers are not cared for as children of older parents.	12.329	.015	11.649	.020
It is very important to be married before having children.	2.603	.411	5.424	.134
Having a baby negatively affects a couple's relationship.	7.308	.088	20.024	.000
Parenting is a skill that takes time and patience to learn.	6.313	.127	11.387	.023
Parenting involves a great deal of commitment and time.	8.334	.067	8.026	.074
Caring for a baby does not require much money.	16.323	.003	22.216	.000
I could afford to raise a baby as a teenager.	21.436	.000	25.146	.000
Responsible				
I would be upset if I (or my girlfriend) was pregnant.	2.412	.482	15.828	.003
Birth control interferes with sexual activity.	11.672	.020	1.678	.646
I could easily raise a child and continue my education.	5.797	.147	13.453	.009
Teenagers should abstain from sexual behaviors.	34.811	.000	48.751	.000
Taking care of an infant is a large responsibility.	28.970	.000	45.412	.000
Parental needs are more important than children's needs.	21.502	.000	12.117	.017
Social				
Having a baby would make me feel better about myself.	8.617	.058	11.137	.025
There are many ways to show that you care other than sexually.	2.944	.461	3.787	.321
Peer pressure causes most teens to become sexually active.	26.453	.000	17.284	.002
My future would be better if I had a baby right now.	25.789	.000	26.623	.000
Being a teen parent would make me more important to my friends.	26.575	.000	19.050	.001
When I have sexual desires, I don't think about babies or parenting.	22.464	.000	11.537	.021

the negative consequences of pregnancy (Henderson, 1980). They fail to recognize problems associated with child care and the potential adverse effects on their personal lives (Holden, Nelson, Valasquez, & Ritchie, 1993). The Department of Health, Education and Welfare reported that 47.8% of students had ever had sexual intercourse, 35.0% of high school students were currently sexually active, and 38.5% of currently sexually active high school students had not used a condom during last sexual intercourse. In 2005, the number of births for girls aged 15 to 17 was about 133,000, or 21 for every 1,000 girls. That number rose to nearly 139,000, or 22 for every 1,000 girls, in 2006. One-third of the girls in

the United States got pregnant before age 20, and more than 435,000 babies were born to teens between 15 and 19 years in 2006 (Eaton et al., 2008).

The infant simulator seemed effective in promoting more responsible behavior. This is shown in Table 1 for the Responsible category where each of the six items (e.g., "I would be upset if I [or my girlfriend] was pregnant," "Teenagers should abstain from sexual behaviors") showed significant change in a positive direction. The researchers believe that an integrated program including the infant simulator and a curriculum based on key sexuality and parenting issues and reflection-based activities can have a

Table 2

Pretest, Posttest, and Follow-up Means and Standard Deviations

Test	Group	Mean	SD
Pretest	Treatment	7.33	2.86
	Comparison	7.24	2.90
Posttest	Treatment	9.98	3.48
	Comparison	7.04	3.62
Follow-up	Treatment	9.62	3.27
	Comparison	7.21	3.46

positive impact on student attitudes and knowledge.

Increased knowledge and improved skills in child care can have a long-term positive impact on adolescent behavior. Whether or not adolescents defer pregnancy, when they do become parents it is important that they improve their level of competence in raising children. This type of program has substantial potential to provide adolescents with a repertoire of skills essential for parenting. An important goal of health education is to provide life skills for adolescents. In New York State, for example, Education Law 804 authorizes schools to include child development, parental skills and responsibilities as an integral part of health education instruction (New York State Education Department, 2008). Evidence provided in this study show that the ChildCare II infant simulator can improve the ability of adolescents to deal with the realities of pregnancy and child care.

Warning students verbally about the consequences of sexual behavior seems to have little effect. These consequences, such as pregnancy, may appear remote and be readily discounted by adolescents. The infant simulator, however, provides a tangible demonstration of the potential

consequences of their behavior because it makes the problem immediate and real. Finally, health educators should consider the feasibility of having students care for the infant simulator for a full week, rather than three days, to demonstrate more vividly the long term implications of parenthood.

Limitations

This study had several limitations. It might be difficult to generalize from the findings because the sample included more females (58.7 percent) and Hispanic students (19 percent) than the total population of high school students. The educational backgrounds of parents might differ from other samples since 10 percent of the parents did not graduate from high school, and 30 percent of the parents graduated from a two or four year college. The findings would be limited to instructional settings in which the RealCare II infant simulator was used with a structured, skill-based curriculum similar to the Realityworks curriculum.

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Table 3

Analysis of Variance for Pretest, Posttest, and Follow-up

Source	df	F	MS	P
Pretest	1	.68	1.73	0.678
Posttest	1	53.75	670.87	0.000
Follow-up	1	53.29	602.67	0.000

Source	U	SS	MS
Pretest	288	2541.78	(8.22)
Posttest	288	3864.71	(12.63)
Follow-up	288	3256.95	(11.31)

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